This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

PATENT SPECIFICATION

Application Date: Feb. 27, 1939. No. 6441/39.

525,730

Complete Specification Left: Dec. 22, 1939.

Complete Specification Accepted: Sept. 3, 1940.

PROVISIONAL SPECIFICATION

Method of Producing Sulphur from Gases Containing Sulphur-dioxide

We, A. G. Exploration Company, Limited, a British Company, of 11, Old Jewry, London, E.C.2, and Cyril Thomas Hill, a British Subject, of "Naseby", Marlow, Buckinghamshire, do hereby declare the nature of this invention to be as follows:—

It has long been known that sulphur dioxide may be caused to react with carbon at high temperature, and that under suitable conditions the chief product of the reaction is elementary sulphur. Velocities of reaction high enough for practical use require temperatures not below 900° C. and preferably in the neighbourhood of 1100° C. The concentration of sulphur dioxide in the gases to be treated should not be too low; for economical usage of carbon, the oxygen content of the gases should be as low as possible.

It has been proposed to effect reduction to sulphur by causing gases containing sulphur-dioxide to pass through a bed of carbonaceous material, usually coke, maintained at high temperature. In such a method it has been proposed to support carbonaceous material on metal grate bars, the gases being introduced below the bars and caused to pass upwards through the bed. Whilst such a method may be successfully used in dealing with gases initially at a relatively low temperature, it is not practicable to allow gases at high temperature to come into contact with metal bars.

The present invention may be employed with gases at any temperature even at 1000° C. or higher. According to the invention, the gases are passed through a mass or column containing the material used for reduction, the mass or column being supported by means placed outside the gas stream and the gases being introduced at a point remote from the support upon which the mass or column rests. Dust and ash are removed by withdrawing part of the mass from the bottom, either at intervals or continuously. The mass is thus caused to descend and the material withdrawn from the reaction zone is given time to cool before reaching the level at which it is supported. The space occupied by the mass or column is restored by the addition of further material at the top.

The mass or column is preferably composed of lump refractory material inert under the conditions of reaction. The refractory material should be of fairly uniform size in order that the mass may be easily traversed by the gases, and is preferably shaped into cubes of 2" to 4" side. The refractory material acts as a carrier for the carbonaceous material required for the reduction, holding it on or within the mass until it reaches the necessary high temperature and enters into reaction with the sulphur dioxide.

Carbonaceous material may be introduced into the mass or column either as finely divided material or in the lump form. If finely divided carbonaceous material is used, this may be allowed to fall from above on to the mass or column, or may be injected into the gas stream by which it is carried into contact with the mass or column. Where lump carbonaceous material is used, this may be added from time to time or continuously either alone, or with the refractory material introduced to replace that withdrawn from the bottom. The carbonaceous material may also be added both in lump form and in finely divided form.

The mass or column will thus be composed partly of inert material and partly of carbonaceous material, and the proportions may be adjusted within wide limits. It will generally be convenient to use such a proportion of carbonaceous material and so to adjust the rate at which material is withdrawn from the column that the carbonaceous material is completely consumed in the reaction, so that the material withdrawn from the bottom is chiefly refractory material with dust and ash but with little or no carbonaceous material.

With a mass or column formed in this way gases do not encounter any great resistance, the sized lumps of refractory material serving to maintain an open structure. The ash formed from the carbonaceous material as it is consumed, together with any dust carried by the gases or formed within the mass, works downwards through the column in consequence of the movement caused by withdrawal from the bottom, and is eventually removed at the bottom with the refractory material.

The mass or column may also be formed of lump carbonaceous material alone. In this case part of the carbonaceous material will be consumed in the reaction and part is withdrawn from the bottom of the mass or column. This withdrawal of lump carbonaceous material has the same effect as withdrawal of lump refractory material in the case in which the bed comprises such material; that is, dust and ash work downwards through the column and are removed with the lump carbonaceous material, and the mass is kept open for passage of the gases.

The invention may be carried out with gases obtained by combustion of sulphide material in any type of furnace. Preferably gases are employed which are already at or near the desired temperature for reaction and which contain a high proportion of sulphur-dioxide. Such gases may be obtained by the combustion of sulphide material in finely divided form under conditions such that the separate particles burn more or less instantaneously whilst suspended in air; this method of combustion is hereinafter referred to as "suspension roasting". The gases obtained by such suspension roasting will normally be at considerably higher temperatures than those obtained from combustion in shelf roasters. The proportion of sulphur-dioxide in the gases may be controlled by adjusting the proportion of air to sulphide material.

The gases obtained by suspension roasting usually carry considerable quantities of dust. The dust will consist chiefly of metal oxide, which can react with sulphur in presence of carbon at high temperature to give oxides of carbon and reform the metal sulphide. If allowed to reach the reducing chamber in large quantities, therefore, such oxide dust may cause blockage by slagging or fritting, and loss of sulphur. It is desirable, therefore, that dust should be removed as far as possible, before the gases pass through the reduction process. For this purpose the gases may conveniently be passed through a cyclone dust extractor formed of firebrick or other refractory material. Such an extractor is preferably incorporated within the same structure as the roasting chamber, efficient insulating material being employed in enclosing both, so that gases carrying very little dust are obtained with the minimum loss of heat.

For the maximum economy in the use of carbon, it is desirable that the gases entering the reduction chamber should be at a temperature in the neighbourhood of 1100° C. and should contain the minimum of free oxygen. In practice, however, it may occur that at very high temperatures the particles of metal oxide dust carried by the gases tend to adhere to and build up on the walls of the dust extractor and flues. To avoid the difficulties which might arise in these circumstances, the temperature may be controlled to that found permissible in practice, for example, by controlling the quantity of air used in the suspension roasting. If the temperature of the gases entering the reduction chamber is much below 1000° C., it will be necessary that the gases should contain a proportion of oxygen, which by reaction with carbon in the reduction chamber will raise the temperature to that required for effective reduction. The sulphur dioxide content of gases obtained for example by suspension roasting of pyrites may vary from 12% to 16% by volume, and the oxygen content from 5% to 0%.

In a pilot plant burning finely divided iron pyrites by suspension roasting, it was found that the temperature of the gases leaving the furnace should not exceed 950° C., in order to avoid deposit of sintered material in the flues and dust extractor, which were of relatively small dimensions. In order to maintain this temperature, the ratio of air to pyrites in the furnace was adjusted to give gases containing about 14% of sulphur-dioxide and 3% of oxygen, which were found to give effective reduction.

Where from the dimensions of the plant or the nature of the sulphide material used there is no risk of deposit of fritted or sintered material in the flues, it is desirable to use the minimum quantity of air necessary to effect complete roasting of the sulphide material. Where pyrites is used, it is possible and desirable to use less than the theoretical quantity of air required for complete combustion, and as little as 90% or even 85% of the theoretical air required may be employed without risk of obtaining cinders high in sulphur. With such limited proportions of air, the gases leaving the furnace will contain free sulphur up to 20 or 30 grams per cubic metre measured at normal temperature and pressure. Such gases are especially suitable for the practice of this invention, since they require minimum consumption of carbon for the sulphur obtained, and since according to the process of the invention the gases do not come into contact with metal or other material which can react with sulphur.

The reduction may be carried out in a reaction shaft or chamber containing the mass or column of lump material and well insulated to avoid loss of heat. The walls of the reduction chamber are provided with ports for the inlet of gases some distance above the level at which the mass or column is supported.

The mass or column may conveniently be supported on a table which is not in the gas stream, so that the table and that part of the mass or column adjacent to it are relatively cool. Withdrawal of lump material may be effected by the operation of a rake which moves over the table, at each movement causing some of the lump material to fall over the edge of the table. Any other suitable means of withdrawal, such as a chain grate or moving belt, or a rotating grate, may be used in place of the rake and table. The falling material may be conveniently collected below the table or grate in a hopper closed by double doors or other suitable gas-tight means. In this way, the lump material withdrawn from the mass can be removed from the apparatus without allowing appreciable inlet of air or outlet of gases.

The relation between the gas velocity and the space occupied by the mass or column must be such as to allow sufficient time of contact for the reaction. The time of contact required will vary with the temperature, with the concentration of sulphur-dioxide in the gases and with the extent of surface of carbonaceous material presented to the gases. Where the mass or column comprises inert refractory material, the surface of reducing material presented to the gases may be varied by adjusting the proportion of lump carbonaceous material in the mass or by varying the ratio of lump to fine carbonaceous material introduced. Where the mass comprises lump carbonaceous material alone the extent of the surface presented may be altered by varying the depth of the bed. The gases may pass through the mass or column either upwards or downwards.

The proportion of the mass or column removed or replaced and the intervals between such removal and replacement may be adjusted according to the ash content of the coke and the amount of dust carried by the gases. The removal and replacement of the material of the mass or column will cause dust and ash to pass downwards, so that the mass or column is kept open to the passage of the gases, the dust and ash being removed from the bottom with the lump material.

The gases leaving the reducing shaft or chamber will be at a high temperature, say between 900 and 1100° C., and will contain free sulphur. Most of the sulphur dioxide originally in the entering gases will have been reduced to sulphur, but small quantities of carbon disulphide and carbon oxysulphide will usually be present, together with that proportion of sulphur dioxide which has escaped reduction. Such exit gases may contain, for example, 180—200 grams of sulphur as element, 5—10 grams of sulphur as carbon disulphide, 5—10 grams as carbon oxysulphide, and 10—20 grams as sulphur dioxide, per cubic metre measured at normal temperature and pressure.

Where the original sulphide mineral has been oxidised by suspension roasting, most of the heat of combustion is carried in the gases to the reducing shaft or chamber and will be carried forward in the sulphur-containing gases leaving that shaft or chamber. Most of this heat may be recovered by passing the gases through a cooler which will act as a waste heat boiler, and this recovery of heat constitutes a valuable practical advantage of the method. The gases may be treated for removal of dust before condensation of the sulphur. The cooler may be adapted only to reduce the temperature of the gases to say 320—350° C. which will generally be above the dewpoint of the elemental sulphur contained in the gases; in this case the gases from the waste heat boiler, after removal, if desired, of any dust they may carry, may be treated in a separate condenser in which the temperature is reduced to the region of 130° C., at which temperature most of the sulphur will be separated in the liquid state. Alternatively, the exit gases from the reducing shaft or chamber may be cooled to the neighbourhood of 130° C. in one operation.

It may be desirable to treat the gases to cause reaction between the remaining sulphur dioxide and the small quantities of carbon oxysulphide and carbon disulphide which may be present. This treatment may be carried out by a catalysing step or steps in known manner. Thus the hot gases coming from the reducing shaft or chamber may first be cooled to appropriate temperature and then passed through a catalyst chamber, the exit gases from this being further cooled for condensation of sulphur. Alternatively, or additionally, the exit gases from the sulphur condensing step may be treated for example by means of scrubbing or absorbing apparatus to recover the sulphur compounds and/or free sulphur in known manner.

Dated this 27th day of February, 1939.

CRUIKSHANK & FAIRWEATHER,
65—66, Chancery Lane, London, W.C.2,
and 86, St. Vincent Street, Glasgow,
Agents for the Applicants.

COMPLETE SPECIFICATION

Method of Producing Sulphur from Gases Containing Sulphur-dioxide

We, A. G. EXPLORATION COMPANY, LIMITED, a British Company, of 11, Old Jewry, London, E.C.2, and CYRIL THOMAS HILL, a British Subject, of "Naseby", Marlow, Buckinghamshire, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improvement in the process of producing sulphur by causing gases containing sulphur dioxide to traverse a mass or column comprising carbonaceous material.

In the proposals hitherto made to produce sulphur by reduction with carbon of gases containing sulphur dioxide, no difficulties have arisen in supporting the carbonaceous material, the usual method of support, namely, spaced metal grate bars on which the material rests, and below which the gases are introduced, being suitable, because of the relatively low temperatures of the gases which it has been proposed to use. Effective reduction requires temperatures not below 900° C., and preferably in the neighbourhood of 1100° C. It is not practicable, however, to allow gases at temperatures approaching or exceeding 850° C. to come into contact with metal grate bars, since the bars would very quickly be burned away. In the prior proposals, therefore, it has been necessary to employ gases containing considerable proportions of free oxygen, the reaction of which with the carbon has supplied the heat necessary to raise the temperature of the gases; in consequence very much larger quantities of carbon have been consumed than were theoretically necessary for the reduction of the sulphur dioxide to elementary sulphur. It is an object of the present invention to avoid the passage of the gases through grate bars or similar supports for the carbonaceous material used for reduction, so that gases at high temperatures and of low oxygen content may be employed.

According to the present improvement, the gases containing sulphur dioxide to be reduced are caused to traverse a mass or column comprising carbonaceous material, without coming into contact with the means on which the mass or column is supported. Carbonaceous material is preferably added to the mass or column at the upper end and residual material withdrawn therefrom at the lower end. The material withdrawn from the reaction zone is thus given time to cool before reaching the level at which it is supported, at the same time, dust and ash are removed from the reaction zone.

The mass or column may be composed in part of lump refractory material inert under the conditions of reaction. The refractory material should be of fairly uniform size in order that the mass may be easily traversed by the gases, and is conveniently shaped into cubes of 2" to 4" side. The refractory material acts as a carrier for the carbonaceous material required for the reduction, holding it within the mass until it reaches the necessary high temperature and enters into reaction with the sulphur dioxide.

Carbonaceous material may be introduced either as finely divided material or in the lump form into this mass or column comprising refractory material. If finely divided carbonaceous material is used, this may be allowed to fall from above on to the mass or column, or may be injected into the gas stream by which it is carried into contact with the mass or column. Where lump carbonaceous material is used, this may be added from time to time or continuously, either alone or with the refractory material introduced to replace that withdrawn from the bottom. The carbonaceous material may also be added both in lump form and in finely divided form.

The mass or column will thus be composed partly of inert material and partly of carbonaceous material, and the proportions may be adjusted within wide limits. It will generally be convenient to use such a proportion of carbonaceous material and so to adjust the rate at which the material is withdrawn from the column that the carbonaceous material is completely consumed in the reaction, and the material withdrawn from the bottom is chiefly refractory material with dust and ash but with little or no carbonaceous material.

With a mass or column formed in this way gases do not encounter any great resistance, the refractory material serving to maintain an open structure. The ash formed from the carbonaceous material as it is consumed, together with any dust carried by the gases or formed within the mass, readily works downwards through the column in consequence of the movement caused by withdrawal from the bottom, and is removed at the bottom with the refractory material.

The mass or column may also be formed of lump carbonaceous material alone. In this case part of the carbonaceous material will be consumed in the reaction and part is withdrawn from the bottom of the mass or column. This withdrawal has the same effect as withdrawal of lump refractory material in the case in which the bed comprises such material; that is, dust and ash work downwards through the column and are removed at the bottom and the mass is kept open for passage of the gases.

The most suitable carbonaceous material for the process is coke, but charcoal may also be used. Effective reduction is obtained with coal also, but the sulphur obtained in this case may be discoloured by hydrocarbons volatilized from the coal and not completely destroyed in the reducing bed. Where the bed is formed from carbonaceous material alone, without refractory material, coke is especially suitable, because of its light open structure, mechanical strength, and freedom from volatile constituents.

The invention may be carried out with any gases containing sulphur dioxide. In the preferred form, as already set out, gases are employed which are already at or near the desired temperature for reaction and which contain a high proportion of sulphur dioxide with no or little oxygen. Such gases may be obtained by the combustion of sulphide material in finely divided form under conditions such that the separate particles burn very rapidly whilst suspended in air; this method of combustion is hereinafter referred to as " suspension roasting ". The gases obtained by such suspension roasting will normally be at considerably higher temperatures than those obtained from combustion in shelf roasters, even for the same concentration of sulphur dioxide. By reducing the ratio of air supplied to mineral burned, it is not difficult in such roasting to obtain gases containing up to 16% of sulphur dioxide with less than 1% of oxygen, and such gases will be at a temperature of 1000° C. or higher unless the furnace is specially cooled. Cooling if required may be effected by the provision of a water cooled bottom and water cooled walls in the furnace.

The gases obtained by suspension roasting usually carry considerable quantities of dust. The dust will consist chiefly of metal oxide, which can react with sulphur in presence of carbon at high temperature to give oxides of carbon and reform the metal sulphide. If allowed to reach the reducing chamber in large quantities, therefore, such oxide dust may cause blockage by slagging or fritting, and loss of sulphur. It is desirable, therefore, that dust should be removed as far as possible, before the gases pass through the reduction process. For this purpose the gases may conveniently be passed through a cyclone dust extractor formed of firebrick or other refractory material.

As set out above, it is desirable that the gases entering the reduction chamber should be at a high temperature and should contain the minimum of free oxygen. In practice it may occur that at very high temperatures the particles of metal oxide dust carried by the gases tend to adhere to and build up on the walls of the dust extractor and flues. To avoid the difficulties which might arise in these circumstances, the temperature may be controlled to that found permissible in practice by providing cooling means in the roasting furnace as explained above. If for this reason it has been found necessary to reduce the temperature of the gases entering the reduction chamber much below 1000° C., the gases should contain a proportion of oxygen, which, as explained above, will raise the temperature to that required for effective reduction by reaction with carbon in the reduction chamber. The sulphur dioxide content of gases obtained for example by suspension roasting of pyrites may vary from 12% to 16% by volume, and the oxygen content from 5% to 0%.

In a pilot plant burning finely divided iron pyrites by suspension roasting, it was found that the temperature of the gases leaving the furnace should not exceed 900° C., in order to avoid deposit of sintered material in the flues and dust extractor, which were of relatively small dimensions. In this pilot plant the heat lost from the walls was naturally higher in proportion to the total heat of roasting than it would be in a big working unit. This loss was compensated by passing the air for combustion through a jacket surrounding the bottom of the furnace, and it was found that under these conditions the desired temperature could be maintained by adjusting the air supply to give exit gases containing about 14% of sulphur dioxide and about 3% of oxygen. These gases were found to react very completely with carbon in the reducing bed, in which they usually maintained the temperature at more than 1000° C.

Where from the dimensions or design of the plant or the nature of the sulphide material used no difficulty arises from deposit of fritted or sintered material in the flues, it is desirable to use the minimum quantity of air necessary to effect complete roasting of the sulphide material. Where pyrites is used, it is possible and desirable to use less than the theoretical quantity of air required for complete combustion, and we have found that as little as 90% or even 85% of the theoretical air required may be employed whilst maintaining substantially complete desulphurisation. With such limited proportions of air, the gases leaving the furnace will be substantially free from oxygen and will contain free sulphur up to 20 or 30 grammes per cubic metre measured at normal temperatures and pressure. Such gases are especially suitable for the practice of this invention, since they consume relatively very little carbon for the sulphur obtained.

The reduction may be carried out in a reaction shaft or chamber of which the internal walls are formed of refractory material, and which contains the mass or column of lump material. The walls of the reduction chamber are provided with ports for the inlet and outlet of gases, the lowest of which is placed some distance above the level at which the mass or column is supported.

The mass or column may conveniently be supported on a table which is not in the gas stream, so that the table and that part of the mass or column adjacent to it are relatively cool. Withdrawal of lump material may be effected by the operation of a rake which moves over the table, at each movement causing some of the lump material to fall over the edge of the table. Any other suitable means of withdrawal, such as a chain grate, or a rotating grate, may be used in place of the rake and table. The falling material may be conveniently collected below the table or grate in a hopper closed by double doors or other suitable gas-tight means. In this way, the material withdrawn from the mass can be removed from the apparatus without allowing appreciable inlet of air or outlet of gases.

In the accompanying drawing there is shown in diagrammatic form, a vertical section through a reaction shaft or chamber in which the process of the present invention may be carried out.

Referring to the drawing, A denotes the reaction shaft or chamber, the internal walls of which are formed of refractory material, B the mass or column of lump material supported on a platform or table C. One or more rakes D is or are adapted to be moved backwards and forwards across the table for example by means of the racks E meshing with pinions F.

The shaft or chamber A is provided at its upper end with a charging hopper G provided with two bells H for rendering such hopper gas-tight and at the lower end with an outlet hopper I which is provided with two slides J or equivalent devices for keeping the hopper I gas-tight. Ports K provide for the inlet and exit of the gases to the chamber A.

The gases preferably pass upward through the mass from the lower port K to the upper port K, the table or platform C supporting the mass being located so far below the lower port K that it is outside the gas stream and the outlet hopper I is relatively cool. Movement of the rake or rakes D over the table C causes material from the bottom of the mass B to fall over the edges of the table C into the outlet hopper I from which it may be removed through the two slides J.

The relation between the gas velocity and the space occupied by the mass or column must be such as to allow sufficient time of contact for the reaction. The time of contact required will vary with the concentration of sulphur dioxide in the gases and with the extent of surface of carbonaceous material presented to the gases, and more particularly with the temperature of the gases. Where the mass or column comprises inert refractory material, the surface of reducing material presented to the gases may be varied by adjusting the proportion of lump carbonaceous material in the mass or by varying the ratio of lump to fine carbonaceous material introduced. Where the mass comprises lump carbonaceous material alone the extent of the surface presented may be altered by varying the depth of the bed. The gases may pass through the mass or column either upwards or downwards.

The proportion of the mass or column removed or replaced and the rate of such removal and replacement may be adjusted according to the ash content of the carbonaceous material and the amount of dust carried by the gases. The removal and replacement of the material of the mass or column will cause dust and ash to pass downwards, so that the mass or column is kept open to the passage of the gases.

The gases leaving the reducing shaft or chamber will be at a high temperature, usually over 1000° C. and will contain free sulphur. Most of the sulphur dioxide originally in the entering gases will have been reduced to sulphur, but small quantities of carbon disulphide and carbon oxysulphide will usually be present, together with that proportion of sulphur dioxide which has escaped reduction. We have found such exit gases may contain, for example, 180—200 grams of sulphur as element, 3—10 grams of sulphur as carbon disulphide, 3—10 grams as carbon oxysulphide, and as little as 5 grams as sulphur dioxide, per cubic metre measured at normal temperature and pressure.

In order to recover in the liquid form the elementary sulphur carried by the gases, the temperature must be reduced to the neighbourhood of 130° C. It may be desirable, however, to treat the gases for removal of dust before condensation of the sulphur. For this purpose the temperature is first reduced in a cooler which may preferably be in the form of a waste heat boiler to say 350—400° C. which will generally be above the dewpoint of the elemental sulphur contained in the gases, and the gases at this temperature treated for removal of dust, for example, in an electrostatic dust precipitator. The temperature is then reduced in a separate condenser to about 130°, and the sulphur separated in the liquid state. Alternatively, the exit gases from the reducing shaft or chamber may be cooled to the neighbourhood of 130° C. in one operation.

It may be desirable to treat the exit gases to cause reaction between the remaining sulphur dioxide and the small quantities of carbon oxysulphide and carbon disulphide which may be present. This treatment may be carried out by a catalysing step or steps in known manner. Thus the hot gases coming from the reducing shaft or chamber may first be cooled to appropriate temperature and then passed through a catalyst chamber, the exit gases from this being further cooled for condensation of sulphur. Alternatively, or additionally, the exist gases from the sulphur condensing step may be treated for example by means of scrubbing or absorbing apparatus to recover the sulphur compounds and/or free sulphur in known manner.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A process of producing sulphur by causing gases containing sulphur dioxide to traverse a mass or column comprising carbonaceous material, in which the gases do not come into contact with the means on which the mass or column is supported.

2. A process according to Claim 1, in which carbonaceous material is added to the mass or column at the upper end, and residual material is withdrawn therefrom at the lower end.

3. A process according to Claim 2 in which the mass or column rests on a table over which a member moves to withdraw material from the mass or column.

4. A process according to Claim 2 or 3, in which the mass or column comprises inert refractory material.

5. A process according to Claim 2 or 3, in which the mass or column is formed of lump coke.

6. A process according to Claim 2 or 3, in which the gases are obtained by suspension roasting of sulphide material.

7. A process according to Claim 6, in which the gases are substantially freed from dust by passing through a cyclone extractor formed of refractory material before traversing the mass or column.

8. A process according to Claim 7, in which the gases are obtained by suspension roasting of iron pyrites.

9. A process according to Claim 7, in which the gases contain not less than 12% by volume of sulphur dioxide.

10. A process according to Claim 9, in which the gases are at a temperature not lower than 850° C.

Dated this 22nd day of December, 1939.

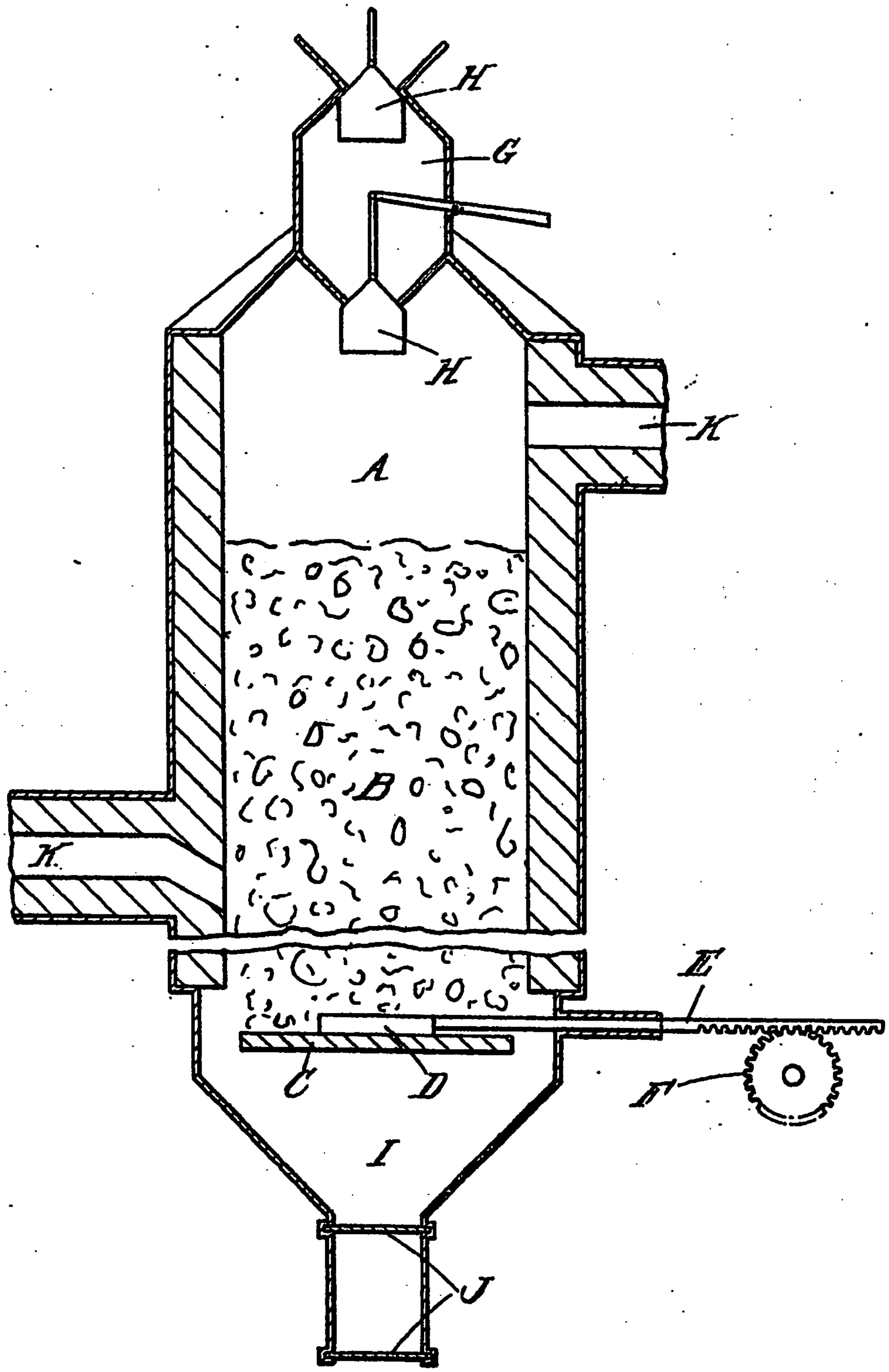
CRUIKSHANK & FAIRWEATHER,
65—66, Chancery Lane, London, W.C.2,
and 29, St. Vincent Place, Glasgow,
Agents for the Applicants.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1940.

525,730 COMPLETE SPECIFICATION

1 SHEET

[This Drawing is a reproduction of the Original on a reduced scale.]



Malby & Sons, Photo-Litho.